Chapter 4
Wet Ponds

4.1 General Description

IMPORTANT

An underdrained gravel trench outlet is required for all discharges within a stream, brook or river watershed. The channel protection volume must be discharged solely through the underdrained gravel trench. Direct discharges to a lake, major river or tidal water may be discharged through standard outlet structures.

Wet ponds are stormwater detention impoundments that have a permanent pool of water and have the capacity to temporarily store storm water runoff while it is released at a controlled rate. They can be designed to provide flood control as well as water quality treatment. Properly sized and maintained, wet ponds can achieve high rates of removal for a number of urban pollutants, including sediment and the pollutants associated with sediment, such as trace metals, hydrocarbons, BOD, nutrients, and pesticides. They also provide some treatment of dissolved nutrients, through biological processes within the pond (Schueler, 1987, MPCA, 1989). The addition of an underdrained gravel trench in the bench area around the permanent pool allows for slow, extended release of stormwater without risk of blockage and effective cooling to avoid thermal impacts. A typical wet pond meeting the Department's BMP standards for water quality and flooding standards for peak flow rates is shown in Figures 4-1 and 4-2. The underdrained gravel trench outlet is required when used to meet the BMP standards discharging to a stream, river or brook. The designer should refer to the referenced material for a more extensive discussion of removal efficiencies and how they compare with other BMPs.

Chapter Contents:

4.2 Site Suitability Criteria

1. **Wildlife Habitat:** If the pond will be used as wildlife habitat or need to enhance habitat, a larger contributing watershed may need to be considered so that flow is sufficient to maintain pool volume. Schueler (1987) suggests that wet ponds for wildlife habitat located in watersheds less than 20 acres should have a reliable water source and a clay liner.. Some guidance on minimum watershed area to sustain a pond with average runoff is given in SCS (1982).

2. **Depth to Bedrock:** Wet ponds should not be located on fractured bedrock because runoff may seep into fractures which may discharge pollutants directly to groundwater. A one foot minimum separation distance is recommended and/or a clay or geosynthetic liner should be provided.

3. **Permanent Flow:** Wet ponds should not be constructed in areas that receive continuous discharge from a spring. Permanent flow into a pond may not allow the detention time needed for pollutant removal to occur.

4. **Location in Stream Channels:** Wet ponds should not be located in existing stream channels because of the impact to aquatic life and a reduction in efficiency of the wet pond.

5. **Location in Wetlands:** Wet ponds must not be located in wetlands without the appropriate permits from DEP and the Army Corps of Engineers. DEP recommends contacting the Army Corps of Engineers early in the design phase if any wet pond is proposed in a wetland as it may not be permitted.

4.3 Design and Construction Criteria

4.3.1 General Criteria

1. **Release of Channel Protection Volume:** The channel protection volume, equal to 1.0 inch times the subcatchment's impervious area plus 0.4 inch times the subcatchment's non-impervious developed area, must be discharged through an underdrained gravel trench outlet over a 24 hour to 36 hour period. When designing for flood control, the pond needs to control the peak from the 2, 10 and 25-year storms.

2. **Permanent Pool Volume:** When designed to meet the BMP standard, the permanent pool must be sized in accordance with criteria to meet the BMP standard provided below. When designed to meet the phosphorus standard, the permanent pool volume is adjusted for any given treatment factor using the equation found in Chapter ___ in Volume II.

IMPORTANT
Performance Criteria for Project in the Direct Watershed of a Lake Where the Phosphorus Standard is Applied

When used to meet phosphorus allocations in lake watersheds, adjust the sizing of the wet pond in accordance with Volume II of this manual.

3. **Soils:** The site for a proposed wet pond should have suitable soils to prevent excessive seepage and compaction to avoid migration of fine soil particles. A wetpond on Group A soils will infiltrate and should be designed as an infiltration structure.

4. **Highly Permeable Soils:** Installation of ponds in highly permeable soils may result in seepage, such that the pool level will have

large fluctuations and the permanent pool may even be totally lost during a dry period. Even though the pond may dry up during the summer months due to the small volume of runoff, pollutant removal will be high if runoff infiltrates through the pond bottom or evaporates rather than discharging through the outlet. There are two design options for ponds which are to be constructed in Hydrologic Group A or B soils that do not normally hold water, or the BMP should be designed as an infiltration bed.

a. *Pond Lining:* The bottom of the pond can be lined with a synthetic membrane or impermeable soil such as clay to prevent water loss (however, see discussion of clay soils, below).

b. *Natural Clogging:* The pond can act as an infiltration basin until clogging of the bottom with sediment and organic material prevents infiltration and creates a wet pond. In this case, standards for separation from bedrock and seasonal high water table provided in the infiltration basin discussion should be used in designing the pond.

5. **Clay Soils:** Installation of ponds in clay soils may be problematic. Outflow from the pond may pick up fine soil particles and carry them to the receiving water course. This is particularly of concern for phosphorus control in sensitive lake watersheds. If construction in clay soils is unavoidable, measures should be taken to prevent this problem, such as:

   • Use of erosion control matting on sides and bottom of pond until aquatic vegetation is established.

   • Lining the pond with a soil filter media that is not susceptible to resuspension (a filter fabric may be required between this material and the clay).

6. **Ponds on Slopes:** When ponds are created by cutting and filling a slope, care should be taken that the seasonal groundwater table on the slope above the pond is not exposed, thus creating a seasonal spring. Controlling the groundwater flow or spring flow into a pond may be accomplished by the proper installation of a subsurface interceptor drainage system.

7. **Wildlife Habitat:** If designed for wildlife habitat, the wet pond should have an irregular shoreline and a combination of shallow and deep areas.

8. **Permanent Pool Depth:** Wet ponds must have a mean depth of 3 feet or more to prevent turbulent resuspension of sediments. Mean depth should be no greater than 10 feet and maximum depth of the pond no greater than 15 feet to avoid thermal stratification and associated release of phosphorus from sediments. Mean depth is defined as the pond volume (measured at one foot below permanent pool elevation) divided by the surface area at that elevation.

9. **Pond Shape to Promote Plug Flow:** Plug flow is accomplished when the flow of water entering the pond does not mix with the water already in the pond but acts to push out all or some of the existing water in the pond. The following measures must be incorporated into design to promote plug flow:

   a. *Flow Path:* The inlet and outlet should be as far apart as possible. Runoff should have to travel the longest distance possible through the pond before being discharged.

   b. *Inlet and Outlet Locations:* Provide one distinct area of inlet flow and one distinct area of outlet flow in the pond. The shallow and narrow end of the pond should be located near the inlet and the deeper and wider end near the outlet.

   c. *Pond Shape:* Provide a long and narrow pond shape, with a minimum length to width ratio of 2:1, 3:1 would be best. Narrowness is important to minimize wind mixing, which

can stir up phosphorus from sediments and release it to outflow. Length-to-width ratio can be increased by designing an irregular shaped pond or by using baffles to create a longer path of flow. The elevation of permanent pool volume can be up to 6 inches over the top of the baffles without destroying plug flow.

d. *Number of Ponds:* Provide two or more ponds in a series for the most effective treatment. The first pond experiences some mixing as incoming runoff meets still water, but water is pushed into subsequent ponds at a steady rate that minimizes mixing and promotes plug flow. Multiple ponds also restrict wind-generated mixing of the total volume of the ponds. Simple overflow outlets should be installed between ponds to ensure that water is released from the top of the pool. This upper layer of water contains less sediment than lower layers.

10. **Relationship to Groundwater:** The elevation of the pond outlet should be at least 1 foot above the highest elevation of the seasonal high groundwater table in the area to be flooded by the pond.

11. **Inlet Design:** If runoff enters the pond via a pipe, the invert of the inlet pipe should be located within 1 foot of the permanent pool elevation to reduce mixing of incoming runoff with the permanent pool and to reduce erosion at the inlet. It is best to avoid submerged inlets because deposition can occur in the pipeline or ice buildup can block the pipe opening. Prevention of scour at the inlet is necessary to reduce maintenance problems and prevent damage to basin floor vegetation. Provide energy dissipation at the inlet in accordance with practices outlined in the Maine Erosion and Sediment Control BMPs Handbook (March 2003).

12. **Scour:** Energy dissipation should be provided at the inlet and outlet to prevent scour and reduce the velocity of stormwater. The velocity of flow through the inlet sediment control

IMPORTANT
Design Tips

- The mean depth of the permanent pool is calculated as the pond volume measured at one foot below the permanent pool elevation divided by the surface area at that elevation.
- Wet ponds shall be designed with a minimum length to width ratio of 2:1; 3:1 would be best.
- Provide a maintenance right-of-way to the pond for access by heavy equipment. Maintenance access shall be planted with grass and at least 10 feet wide with a maximum slope of 15% and a maximum cross slope of 3%.
- The maximum grade of the emergency spillway may not exceed 20% unless a non-flexible lining is used to control erosion within the spillway.
- The design flow depth in the emergency spillway may not exceed one-half the d50 stone size for channels lined with riprap and 3" for channels lined with un-reinforced vegetation.
- A geotechnical engineer must design and submit a report on any embankment over 10' high or posing a significant hazard to downstream property or life.
- A safety bench should be designed into all embankments.
- Construction of ponds must be complete with side slopes and banks stabilized with grass or conservation mix seeding before allowing the pond to fill with water.
- Ponds must be vegetated by the end of the growing season or construction postponed till the next season.
- Avoid introduction of invasive species. A qualified wetland biologist should be consulted when planning the vegetation of a wet pond.

structure and pond should not exceed 2.5 feet per second.

13. **Provisions for Sediment Disposal:** Reservation of land on site for construction sediment disposal should be considered. For sensitive lake watersheds, DEP requires two sites to be reserved for on-site disposal of sediment excavated from the wet pond(s). These sites should be located such that water draining from the material could not flow directly to the water resources being protected.

14. **Access:** Maintenance access shall be planted with grass and at least 10 feet wide with a maximum slope of 15% and a maximum cross slope of 3%. This access should never cross the emergency spillway, unless the spillway has been designed for that purpose.

15. **Sediment Pretreatment:** Pretreatment devices such as grassed swales, underdrained swales, filter strips, filter fabric and sediment traps shall be provided to minimize the discharge of sediment to the wet pond. Pretreatment structures shall be sized to hold an annual sediment loading. An annual sediment load shall be calculated using a sand application rate of 500 lbs/acre for sanding of roadways, parking areas and access drives within the subcatchment area, a sand density of 90 lbs per cubic foot and assuming a minimum frequency of ten sandings per year. To obtain an annual sediment volume, perform the calculation below.

16. **Emergency Spillways:** Emergency spillways shall be designed to independently convey the routed runoff from at least the 25-year, 24-hour storm while maintaining at least one foot of freeboard between the peak storage elevation and the top of the embankment crest and to safely convey the 100-year storm without overtopping the embankment. Overflow must discharge to a stable channel or established wetland area.

a. *Location:* Emergency spillways must be located on undisturbed, non-fill soil wherever possible. If the spillway must be located on fill soils, then it must be horizontally offset at least 20 feet from the principal outlet and be designed with a riprap lining, reinforced-turf lining, or a non-flexible lining.

b. *Exit channel grade*: The maximum grade of the spillway's exit channel may not exceed 20% unless a non-flexible lining is used to control erosion within the channel. Vegetation, reinforced turf, riprap, and modular blocks are considered flexible linings. All linings must be evaluated for stability at the channel grade chosen. There shall be no large woody species growing in the emergency spillway that could interfere with its function.

c. *Flow depth:* The design flow depth in the exit channel may not exceed one-half the d50 stone size for channels lined with riprap and three inches for channels lined with un-reinforced vegetation. The channel shall be designed to remain stable through the full range of design flows.

17. **Embankments:** Embankments must be designed by a professional engineer registered in the State of Maine. The design must include an investigation of the subsurface conditions at the proposed embankment location to evaluate settlement potential, groundwater impacts, and the need for seepage controls. The department will require the submittal of a geotechnical report from a geotechnical engineer for any embankment over 10 feet in effective height or posing a significant hazard to downstream property or

To obtain an annual sediment volume, perform the following calculation:

$$\textit{Area to be sanded (acres)} \times 500 \frac{\text{pounds}}{\text{acre-storm}} \div 90 \frac{\text{pounds}}{\text{ft}^3} \times 10 \frac{\text{storms}}{\text{year}} = \textit{cubic feet of sediment/yr}$$

life. Standards for small embankment ponds and basins can be found in Section G-2 of the Maine Erosion and Sediment Control BMPs Handbook (March 2003).

a. *Crest elevation:* The minimum elevation of the top of the settled embankment must be at least one foot above the peak water surface in the basin with the emergency spillway flowing at design depth for the design storm routed through just the emergency spillway.

b. *Crest width:* The minimum crest width for any embankment must be as shown in the following table:

Effective Height of Embankment (feet)	Crest Width (feet)
Less than 10	6
10-15	8
15-20	10
20-25	12
25-35	14
more than 35	15

c. *Key:* Embankments must be keyed into undisturbed subsurface soils.

d. *Fill Material:* Fill must be free of frozen soil, rocks over six inches, and sod, brush, stumps, tree roots, wood, or other perishable materials. Embankment fills less than 10 feet in fill height must be compacted using compaction methods that would reasonably guarantee that the fill density is at least 90% of the maximum density as determined by standard proctor (ASTM-698). All embankment fills more than 10 feet in fill height must be compacted to at least 90% of the maximum density as determined by standard proctor (ASTM-698) and must have their density verified by field density testing.

e. *Slopes:* The embankment's slopes may not be steeper than 2:1. Flatter slopes provide easier access and maintenance (mowing) of the basin. At a minimum, one side slope, interior or exterior, must be 3:1, such that the combined interior and exterior embankment should total 5:1 (2:1 + 5:1). For safety reasons and to promote the growth of rooted aquatic plants, a gradually sloped bench of 10:1 (H:V) slope around the pond perimeter is recommended. This bench should extend into the pool at least 10 feet (for very small ponds, a 5-foot bench would be sufficient). The bench reduces the potential for accidental falls into the pond and makes it easier to climb out. The underdrained gravel filter bench can be designed to also serve as the safety bench. If it is not possible for a shallow bench to extend around the pond, thorny bushes can be planted to discourage access. Riprap can also be installed around the edge of the pond in accordance with SCS guidance. The inlet area of the pond should be located within the flat bench area.

IMPORTANT
Design Tips - Vegetation

Seed mixtures must be appropriately selected for the soil type, moisture content, the amount of sun exposure, and the level of use as found at the site. Examples are as follows:

Lots of sun and mostly dry:	Creeping red or tall fescue, perennial rye grass and clover
Shady areas:	Creeping red fescue, Kentucky bluegrass, Canada bluegrass
Wetlands:	Creeping red fescue, Reed canary grass, Timothy
Steep slopes:	Crownvetch, clover

The mixture should include some annual rye for quicker green-up. Apply at the approximate rate of 0.5 -1 lbs per 1,000 SF (30-50 lbs per acre). Contact your Soil and Water Conservation District for specific mixtures.

18. **Vegetation:** Aquatic plants shall be used to stabilize the pond, control sedimentation and utilize nutrients. Appropriate species should be carefully selected for different sections of the pond. Appropriate plants should be chosen to stabilize the sides and bottom of the pond, as well as the safety bench. Prior to filling the ponds, side slopes and banks must be stabilized with grass or conservation mix seeding to prevent erosion. Creation of a marsh environment at the pond inlet will help to trap sediment. If the inlet has a sump, aquatic plants can be planted upstream of the sump to help retain sediments in the sump. Fertilizer should not be used in or around the pond except when necessary to establish new vegetation. Allowing for natural invasion along the safety bench or planting native species may encourage healthier growth than planting species not already found on site. Also, use of foreign species is not recommended because of the potential for introducing nuisance plants to the water course receiving the wet pond discharge.

    Particular care must be used to avoid the unintended introduction of invasive species such as purple loosestrife (Lythrum salicaria) and common reed (Phragmites australis). It is recommended that a qualified wetland biologist be consulted when planning the revegetation of a wet pond.

19. **Pond Drain:** If elevations allow, a manually controlled drain should be provided to dewater the pond over a 24 hour period without harming downstream water courses. This will facilitate removing accumulated sediment at periodic (but infrequent) intervals. The drain should be locked to prevent accidental draining of the pond.

20. **Construction:** Construction of wet ponds should be timed so that the ponds do not fill up with water until their construction is substantially finished. Construction of ponds should be planned so as not to take more than 1 to 2 weeks, excluding major weather delays. Construction can be started no later than September 1 or earlier than June 1. If sideslopes and banks cannot be revegetated and stabilized by the end of the growing season, pond construction should be changed to the following year. Seeding or stabilization must occur by September 15 in preparation for the winter season.

4.3.2 Criteria to Meet the BMP Standards

IMPORTANT
Performance Criteria for Discharges Where the BMP Standard is Applied

- The permanent pool must hold a volume equal to 1.5 inches times subcatchment's impervious area plus 0.6 inches times subcatchment's non-impervious developed area.
- The channel protection volume must be designed to detain 1.0 inch times the subcatchment's impervious area plus 0.4 inch times the subcatchment's non-impervious developed area.
- The channel protection volume must be discharged through an underdrain gravel trench over a 24 to 36 hour period.
- The underdrain trench outlet must be sized to provide effective cooling of the stormwater runoff to 60 degrees Fahrenheit.

1. **Permanent Pool Volume:** The permanent pool must be designed to hold a volume equal to 1.5 inches times the subcatchment's impervious area plus 0.6 inch times the subcatchment's non-impervious developed area. If the total volume is split fairly evenly between two ponds in series, the total permanent pool volume required may be reduced by 10%. If three ponds are used, the allowed reduction is 20%.

2. **Channel Protection Volume:** Wet ponds must be designed to detain, above the permanent pool, a runoff volume equal to 1.0 inch times the subcatchment's impervious area plus 0.4 inch times the subcatchment's landscaped developed area unless the pond discharges directly to a major river, lake or tidal water. This volume must be released over a 24 to 36 hour period. The design engineer is responsible for developing and specifying a design that meets the performance criteria based on site specific characteristics.

3. **Cooling:** When designed to meet the BMP standard, the underdrain trench outlet must be sized to provide effective cooling of the stormwater runoff to 60 degrees Fahrenheit. The underdrained outlet design should provide adequate cooling of stormwater runoff before discharging it.

4. **Outlet:** The channel protection volume must be discharged solely through an underdrained gravel trench outlet having a single outlet with a diameter no greater than eight inches unless the pond discharges directly to a major river, lake or tidal water. Additional storage for flood control may be discharged through traditional pond outlets, flood control outlets, at an elevation above the permanent pool and channel protection volume storage. For all discharges within a stream, brook or river watershed, an underdrain gravel filter must be provided. For direct discharge into a major river segment, coastal watershed or lake, a standard pond outlet may be provided.

5. **Underdrained Gravel Trench:** The underdrain trench design is intended to meet the slow release of the channel protection volume over a 24 to 36 hour period and to provide adequate cooling of stormwater runoff from a wet pond. The site design engineer is responsible for developing and specifying a design that meets the performance criteria based on site specific characteristics.

a. *Bench Elevation:* The bench must be set at the permanent pool elevation such that the channel protection volume will be stored between the bench surface elevation and the elevation of any flood control or emergency spillway outlets.

b. *Pond Bench and Gravel Trench:* The gravel trench must be excavated in a pond bench having a minimum width of eight feet. The trench must be four feet wide and at least 2 feet from the pond side edge of the bench and must be located at or near the end of the pond, furthest from the principal inflow.

c. *Trench Sizing:* The trench must have a length of 3 feet for every 1000 cubic feet of channel protection volume.

d. *Trench Dimensions:* The gravel trench must be 4 feet wide and at least 3 feet deep. The pipe underdrain system should have at least 2 feet of gravel cover and six inches below the drainage pipe.

e. *Geotextile Fabric:* A geotextile fabric with suitable characteristics must be placed between the gravel trench and adjacent soil. The fabric will prevent the surrounding soil from migrating into the trench and clogging the outlet. Use an appropriate geotextile design manual to choose a fabric that is compatible with the surrounding soil for the purposes stated above. Overlap seams should be a minimum of 12 inches.

f. *Underdrain Pipe:* The underdrain piping should be 6 inch diameter with slotted, rigid schedule 40 PVC or SDR35 pipe.

g. *Gravel Bed:* The gravel bedding should be a clean well draining gravel. Recommended specification is the gravel meeting MEDOT specification 703.22 Type B Underdrain Backfill materials with at least 10% passing the #50 sieve. MEDOT specifications for underdrain backfill material are provided in the following table:

MEDOT Specifications for Underdrains (ME DOT #703.22)	
Sieve Size	**% by Weight**
Underdrain Type B	
1”	90-100
1/2”	75-100
#4	50-100
#20	15-80
#50	0-15
#200	0-5
Underdrain Type C	
1”	100
3/4”	90-100
3/8”	0-75
#4	0-25
#10	0-5

h. *Orifice:* If the gravel does not provide 24 to 36 hours of maximum detention or the gravel (MEDOT specification 703.22 Type B) does not have at lease 10% passing the #50 sieve or if the sieve analysis is unavailable, then an orifice shall be provided at the outlet to control the release of flows. The orifice should be sized and modeled as a function of the required channel protection volume (CPV) release rate. The following table shows examples of possible pond orifices for channel protection volumes. These sizes are provided for guidance only and because of the small orifice sizes, the engineer is responsible for developing a design that meets the performance criteria based on the site specific characteristics and the required drainage time.

Example Pond Outlet Orifice			
CPV (cu ft)	**Orifice Diameter (in)**	**CPV (cu ft)**	**Orifice Diameter (in)**
8000-9500	1 3/2	24000-26500	2 3/2
9500-11000	1 1/2	26500-29000	2 1/2
11000-13000	1 5/8	29000-32000	2 5/8
13000-15000	1 3/4	32000-35000	2 3/4
15000-17000	1 7/8	35000-38000	2 7/8
17000-19000	2	38000-41500	3
19000-21500	2 1/8	41500-45000	3 1/8
21500-24000	2 1/4	45000-48500	3 1/4

i. *Outlet clogging:* The pond outlet or orifice shall be designed to prevent clogging and to allow access to the underdrain outlet for inspection and maintenance. This may be accomplished by having the underdrain discharge to a concrete sump outlet structure with the orifice built into this structure.

j. *Alternative Outlets:* A 4-inch gate valve on the structure may be used in lieu of a standard orifice. This would allow for adjustment for site specific conditions. The engineer is responsible for designing an outlet structure that meets the release and cooling criteria previously presented.

6. **Pond Outlet:** All pond discharges must outlet to a stable natural channel or an area capable of withstanding concentrated flows and saturated conditions without eroding.

7. **Overflow:** If the pond is used for a project which does not need to provide peak flow control, the overflow from the pond may either be discharged uncontrolled through a broad crest weir or a standard outlet. If the pond needs to retain peak flows for flood control, then a standard outlet for peak control needs to be provided. Discharge from the pond needs to be directed to a stable channel or an area capable to withstand concentrated flows.

4.3.3 Criteria for Standard Outlets and Peak Control

Standard Outlets: Flood control outlets shall be designed to control runoff from the 24-hour storms of the 2-year, 10-year, and 25-year frequencies such that the peak flows of stormwater from the project site do not exceed the peak flows of stormwater prior to undertaking the project. The bottom peak flow control structure must be no lower than the maximum elevation of the channel protection volume if that treatment is required.

1. **Discharge from Pond Surface:** The flood control outlet should be of the simple overflow type to discharge the clarified water from near the surface of the pool.

2. **Piping Materials:** Piping should be constructed of materials with a service life corresponding to the anticipated design life of the pond and its embankment. Reinforced concrete pipe is often recommended in a freshwater environment, but other materials may also be determined to be suitable.

3. **Trash Racks:** All pond outlets must have a trash rack to control clogging by debris and to provide safety to the public. The surface area of each rack must be at least four times the outlet opening it is protecting. The spacing between rack bars must be no more than six inches or one-half the dimension of the smallest outlet opening behind it, whichever is less. Trash racks should be inclined to be self-cleaning.

4. **Seepage Controls:** All pipes that extend through an embankment should have anti-seep collars or filter diaphragms to control the migration of soil materials and to prevent potential embankment failure from "piping" within the soil backfill along the conduit. All smooth outlet pipes greater than eight inches and all corrugated outlet pipes greater than 12 inches must have seepage controls to prevent migration of soil along the outside of the pipe.

5. **Anti-floatation:** All outlets employing a riser structure must be designed to prevent the riser floating.

6. **Outlet Protection:** Outflow from the pond must be directed to a stable channel. The channel should remain shaded when cold water fisheries may be impacted. The channel may need to be riprapped to prevent erosion. Riprap should be designed in accordance with the Maine Erosion and Sediment Control BMP Manual, 2003.

4.3.4 Maintenance Criteria

1. **Maintenance Agreement:** A legal entity should be established with responsibility for inspecting and maintaining a wet pond. The legal agreement establishing the entity should list specific maintenance responsibilities and provide for the funding to cover long-term inspection and maintenance.

2. **Clearing Inlets and Outlets:** The inlet and outlet of the pond should be checked periodically to ensure that flow structures are not blocked by debris. All ditches or pipes connecting ponds in series should be checked for debris that may obstruct flow. Inspections should be conducted monthly during wet weather conditions from March to November. It is important to design flow structures that can be easily inspected for debris blockage.

3. **Gravel Trench Outlet Inspection:** The gravel trench outlet should be inspected after every major storm in the first few months to ensure proper function. Thereafter, the gravel trench should be inspected at least once every six months. Inspection consists of verifying that the pond is slowly emptying through the gravel filter for a short time (12-24 hours) after a storm and that potentially clogging material such as accumulations of decaying leaves are not preventing discharge through the gravel.

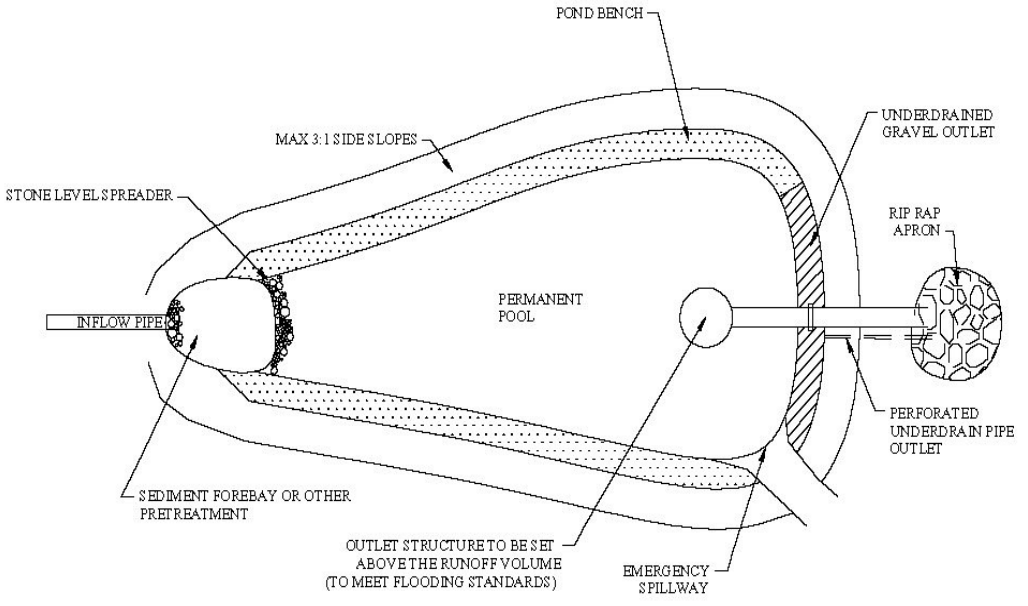
4. **Gravel Replacement:** The top several inches of the gravel in the outlet trench must be replaced with fresh material when water ponds above the permanent pool for more than 72 hours. The removed sediments should be disposed of in an acceptable manner.

5. **Inspecting Ponds for Instability and Erosion:** Wet ponds should be inspected annually for erosion, destabilization of side slopes, embankment settling and other signs of structural failure. Corrective action should be taken immediately upon identification of problems.

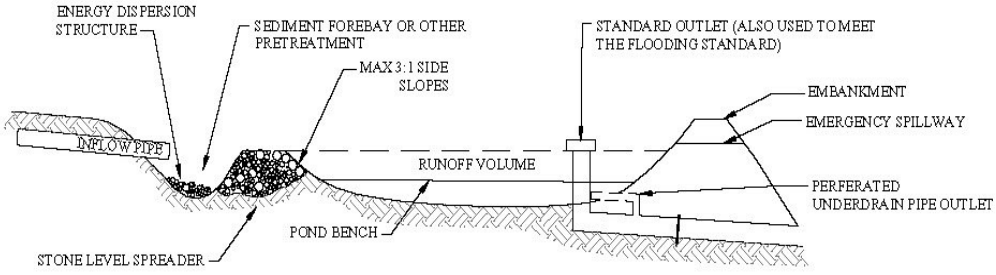
6. **Maintenance Dredging:** Wet ponds lose 0.5-1.0% of their volume annually due to sediment accumulation. Dredging is required when accumulated volume loss reaches 15%, or approximately every 15-20 years.

Selected References

Maine DEP. 2003. *Maine Erosion and Sediment Control BMPs.* Bureau of Land and Water Quality and Maine Department of Environmental Protection.

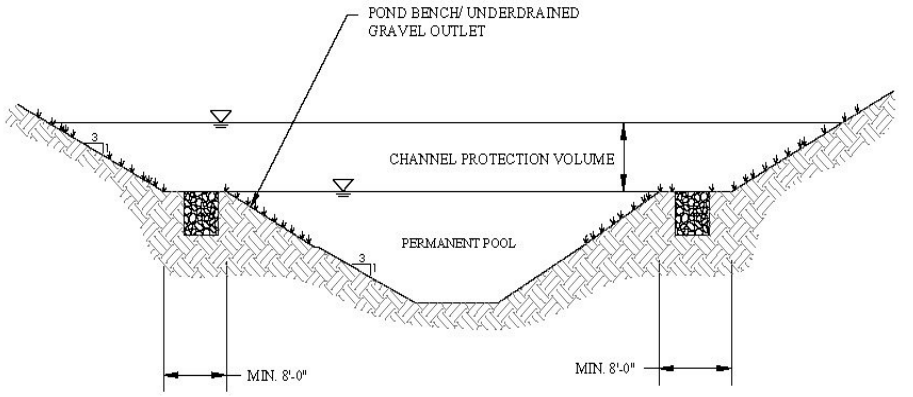


PLAN VIEW

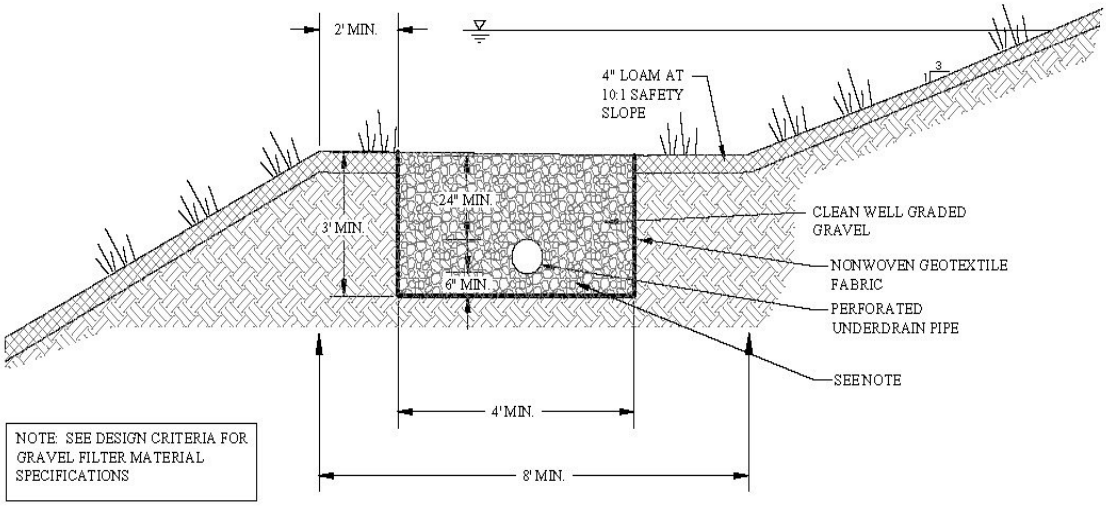


PROFILE

FIGURE 4-1. TYPICAL WET POND WITH UNDERDRAIN OUTLET



CROSS - SECTION



POND BENCH UNDRAINED GRAVEL FILTER DETAIL

FIGURE 4-2. TYPICAL WET POND WITH UNDERDRAIN OUTLET